

IN THE UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF DELAWARE

LG DISPLAY CO., LTD.,

Plaintiff,

v.

CHI MEI OPTOELECTRONICS  
CORPORATION, et al.

Defendants.

Civil Action No. 06-726 (JJF)

Civil Action No. 07-357 (JJF)

**CONSOLIDATED CASES**

**DECLARATION OF DR. GEORGE M. PHARR**

I, George M. Pharr, hereby declare as follows:

1. I am a Professor in the Materials Science and Engineering Department of the University of Tennessee, Knoxville, where I have been on the faculty since 1998. I have been retained as an expert in this matter by McKenna Long & Aldridge LLP on behalf of LG Display Co., LTD.

2. My research areas include nanoindentation and nanomechanical testing, thin film and small-scale mechanical behavior, mechanisms of fracture and flow in solids, and finite element modeling of indentation contact. I am an author or co-author of more than 180 scientific publications, including 4 book chapters, and a Thomson ISI "Highly Cited Researcher in Materials Science." My research focuses on nanoindentation and small-scale mechanical behavior of materials. My curriculum vitae, which includes a list of selected awards and honors, professional activities, and selected publications, is attached as Exhibit A.

3. For this declaration, I reviewed U.S. Patent No. 6,734,944 ("the '944 patent") and the portion on pages 24-25 of AUO's Opening Claim Construction Brief related to the '944 patent.

4. Although claims 1 and 4 provide formulas for the dynamic hardness value ("DH") and the plastic deformation value ("HV") of spacers, the equations include a constant that must be known. Specifically, the equations include a constant "K" that is dependent on the geometry of indentors used to measure DH and HV. There is not a universal value for K that applies to all indentors. Because the '944 patent does not specify which indenter and constant K should be used to measure DH and HV of spacers in an LCD device, the equations alone are insufficient. Selection of one indenter for testing could result in a measured value that falls within the range of the '944 patent, whereas a different indenter testing the same material could result in a value that falls outside the range.

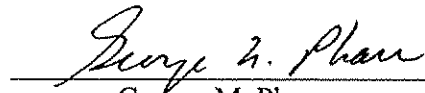
5. Furthermore, even assuming the constant "K" was defined, the measurements for DH and HV could significantly vary depending on other test parameters, such as (a) the penetration depth of the indenter in relation to the thickness of the spacers, (b) the value of maximum load (Pmax), (c) the rate at which the indenter penetrates into the spacers, and (d) the underlying substrate during measurement.

6. It is my understanding that claim 4 requires that a photosensitive resin is selected based on at least one of: (a) a dynamic hardness value within a specific range; (b) a hardness value of plastic deformation within a specific range; (c) an elastic coefficient within a specific range and a linear expansion coefficient which is nearly equal to the coefficient of volume expansion per unit area of the liquid crystal; (d) a specific spacer geometry; and (e) a column occupancy ratio within a specific range. Selection of the photosensitive resin for placing spacers

in a liquid crystal display device would not be made based on the "column occupancy ratio" alone.

I declare under penalty of perjury under the laws of the United States America that the foregoing is true and correct.

Executed on August 29, 2008.

  
George M. Pharr

# **EXHIBIT A**

**EXHIBIT A****CURRICULUM VITAE****for****GEORGE M. PHARR**

**Academic Title:** McKamey Professor of Engineering  
Head, Department of Materials Science & Engineering  
Joint Faculty, Oak Ridge National Laboratory

**Business Address:** The University of Tennessee  
Department of Materials Science & Engineering  
434 Dougherty Engineering Building  
Knoxville, TN 37996-2200  
Telephone: (865) 974-8202  
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**Date of Birth:** May 28, 1953 - Atlanta, Georgia (U.S. citizen)

**Education:** Rice University, B.S. - Mechanical Engineering, 1975  
(Magna Cum Laude)  
  
Stanford University, M.S. - Materials Science and  
Engineering, 1977  
  
Stanford University, Ph.D. - Materials Science and  
Engineering, 1979

**Professional &  
Educational  
Experience:** Research Assistant - Los Alamos Scientific Laboratory,  
Los Alamos, NM, development of subterrene  
penetrators, 1975  
  
Research Assistant - Department of Materials Science,  
Stanford University, deformation of solids, 1975-1979  
  
Metallurgical Consultant - Failure Analysis Associates,  
Palo Alto, CA, product liability failure analysis, 1976-1979  
  
Postdoctoral Research Associate - Cambridge University,  
Cambridge, England, experimental and theoretical  
developments in creep, 1979-1980  
  
Professor of Materials Science - Rice University,  
Houston, TX, 1980-1998 (Assistant Professor 1980-1985;  
Associate Professor 1985-1991)  
  
Consultant - Sandia National Laboratories, Albuquerque,  
NM, nuclear waste isolation in rock salt, 1981-1986

**Professional &  
Educational  
Experience  
(continued):**

Consultant - Kalium Chemicals, Chicago, IL, mechanical properties of alkali halide salts, 1987-1993

Affiliate - Los Alamos National Laboratory, mechanical properties of surface hardened materials, 1987-1992

Visiting Scientist - IBM Thomas J. Watson Research Center, Yorktown Heights, NY, sabbatical 1987-1988

Master - Wiess College, Rice University, 1989-1994

Visiting Scientist - Oak Ridge National Laboratory, Oak Ridge, TN, sabbatical 1994-1996

Professor of Materials Science and Engineering, The University of Tennessee, 1998-present

UT/ORNL Collaborating Scientist and Joint Faculty, Oak Ridge National Laboratory, 1998-present

Adjunct Professor of Biomedical Engineering, The University of Memphis, 2002-2005

Head - Department of Materials Science and Engineering, The University of Tennessee, 2006-present

Deputy Director - Joint Institute for Advanced Materials, The University of Tennessee, 2006-present

**Honors &  
Awards:**

ASME Hugh Scott Cameron, 1975

Outstanding Senior Engineer - Rice University, 1975

Corning Foundation Fellowship in Materials Science - Stanford University, 1976-1977

Fannie and John Hertz Foundation Fellow, 1977-1979

NSF Postdoctoral Fellow - University of Cambridge, 1979-1980

Exxon Faculty Development Award - Rice University, 1982-1985

**Honors &  
Awards  
(continued)**

IBM Faculty Development Award - Rice University,  
1984-1986

ASM Bradley Stoughton Award for Young Teachers of  
Metallurgy, 1984

Rice University Young Alumni Achievement Award, 1985

Amoco Teaching Award, Rice University, 1994

Fellow of ASM International - elected 1995

Senior Research Fellow - SHaRE Program, U.S.  
Department of Energy, 1996-1998

University of Tennessee Science Alliance Award for  
Outstanding Research Achievement, 2001

ISI "Citation Classic" Recognition, 2001

ISI "Highly Cited Researcher" in Materials Science, 2003

Engineering Research Fellow Award - University of  
Tennessee, College of Engineering, 2003-2004

Moses E. and Mayme Brooks Distinguished Professor  
Award, University of Tennessee College of Engineering,  
2004

Faculty Award for Overall Excellence in Teaching,  
Research, and Service, University of Tennessee  
Department of Materials Science and Engineering, 2004

Chancellor's Award for Research and Creative  
Achievement - University of Tennessee, 2004

Engineering Research Fellow Award - The University of  
Tennessee, College of Engineering, 2005

Thomson-ISI "New Hot Paper" Recognition, 2005

McKamey Professor of Engineering - The University of  
Tennessee, College of Engineering, 2007-present

Humboldt Research Award for Senior US Scientists -  
Alexander von Humboldt Foundation, 2007

Chancellor's Professor - University of Tennessee, 2008-present

**Editorial Positions:**

*Journal of the American Ceramic Society*, Associate Editor, 1990-present

*MRS Bulletin*, Volume Editor for the year 2000

*Journal of Materials Research*, Principle editor, special focus issue on "Instrumented Indentation Testing", January 2004

*Philosophical Magazine*, Guest Editor, special issue on "Instrumented Indentation Testing in Materials Research and Development", 21 Nov - 11 Dec, 2006.

**Professional Society Membership:**

American Ceramic Society, Materials Research Society, ASM International, Metallurgical Society of AIME, Tau Beta Pi, Registered Professional Engineer (Texas # 59094)

**Professional Society Activities:**

Executive Committee – ASM Houston Chapter, 1982-1984

Instructor - Metals Engineering Institute, 1984

AIME Book Publishing Committee, 1987-1995

Board of Directors - Sigma Xi Houston Chapter, 1989-1991

Symposium Chair - Mechanical Properties of Films and Coatings, International Conference on Metallurgical Coatings, San Diego, CA, April 1989

Symposium Chair - Thins Films: Stresses and Mechanical Properties II, 1990 Spring Meeting of the Materials Research Society, San Francisco, CA, April 1990

Symposium Chair - Mechanical Properties of Films and Coatings, International Conference on Metallurgical Coatings and Thin Films, San Diego, CA, April 1992

Meeting Chair - 1995 Spring Meeting of the Materials Research Society, San Francisco, CA, April 1995

Materials Research Society Meeting Program Committee, 1995 - 1998

Vice Chair - 1998 Gordon Research Conference on Thin Film Mechanical Behavior, Plymouth, NH, June 1998

Chair - 2000 Gordon Research Conference on Thin Film Mechanical Behavior, Plymouth, NH, July 2000

Program Committee - Fourth European Symposium on Nanomechanical Testing (nanomech 4), Hueckelhoven, Germany, September 2003

Program Committee - Fifth European Symposium on Nanomechanical Testing (nanomech 5), Hueckelhoven, Germany, September 2004



Chair and Organizer - NSF Workshop on High Pressure  
Phase Transformations, Knoxville, TN, August 2005  
Program Committee - Sixth European Symposium on  
Nanomechanical Testing (nanomech 6), Hueckelhoven,  
Germany, August 2005  
Chair and Organizer – ECI Conference on Instrumented  
Indentation Testing in Materials Research and  
Development, Fodelle Beach, Crete, October 2005  
Program Committee - Seventh European Symposium on  
Nanomechanical Testing (nanomech 7), Hueckelhoven,  
Germany, August 2006  
Program Committee - Eighth European Symposium on  
Nanomechanical Testing (nanomech 8), Hueckelhoven,  
Germany, August 2007  
Co-Chair and Organizer - International Symposium on  
Indentation Behaviour of Materials, Hyderabad, India,  
February 2008

# SELECTED PUBLICATIONS - G. M. Pharr

## Articles

- G.M. Pharr and W.C. Oliver, "Nanoindentation of Silver - Relations Between Hardness and Dislocation Structure", *Journal of Materials Research* **4**, p.94 (1989).
- G.M. Pharr, W.C. Oliver and D.R. Clarke, "Hysteresis and Discontinuity in the Indentation Load-Displacement Behavior of Silicon", *Scripta Metallurgica* **23**, p. 1949 (1989).
- G.M. Pharr and R.F. Cook, "Instrumentation of a Conventional Hardness Tester for Load-Displacement Measurement During Indentation", *Journal of Materials Research* **5**, pp. 847-851 (1990).
- R.F. Cook and G.M. Pharr, "Direct Observation and Analysis of Indentation Cracking in Glasses and Ceramics", *Journal of the American Ceramic Society* **73**, pp. 787- 818 (1990).
- G.M. Pharr, W.C. Oliver and D.R. Clarke, "The Mechanical Behavior of Silicon During Small-Scale Indentation", *Journal of Electronic Materials* **19**, pp. 881-887 (1990).
- G.M. Pharr, W.C. Oliver, and D.S. Harding, "New Evidence for a Pressure-Induced Phase Transformation During the Indentation of Silicon", *Journal of Materials Research* **6**, pp. 1129-1130 (1991).
- G.M. Pharr, W.C. Oliver, and F.R. Brotzen, "On the Generality of the Relationship Among Contact Stiffness, Contact Area, and Elastic Modulus During Indentation", *Journal of Materials Research* **7**, pp. 613-617 (1992).
- G.M. Pharr, W.C. Oliver, R.F. Cook, P.D. Kirchner, M.C. Kroll, T.R. Dinger, and D.R. Clarke, "Electrical Resistance of Metallic Contacts on Silicon and Germanium During Indentation", *Journal of Materials Research* **7**, pp. 961-972 (1992).
- W.C. Oliver and G.M. Pharr, "An Improved Technique for Determining Hardness and Elastic Modulus Using Load and Displacement Sensing Indentation Experiments", *Journal of Materials Research* **7**, pp. 1564-1583 (1992).
- G.M. Pharr and W.C. Oliver, "Measurement of Thin Film Mechanical Properties Using Nanoindentation", *MRS Bulletin* **17**, pp. 28-33 (1992).
- R.F. Cook and G.M. Pharr, "Indentation Load-Displacement Behavior During Conventional Hardness Testing", *Journal of Hard Materials* **5**, pp. 179-190 (1995).

- G.M. Pharr, D.L. Callahan, S.D. McAdams, T.Y. Tsui, S. Anders, A. Anders, J.W. Ager III, I.G. Brown, C.S. Bhatia, S.R.P. Silva, and J. Robinson, "Hardness, Elastic Modulus, and Structure of Very Hard Carbon Films Produced by Cathodic-Arc Deposition with Substrate Pulse Biasing", *Applied Physics Letters* **68**, pp. 779-781 (1996).
- T.Y. Tsui, W.C. Oliver, and G.M. Pharr, "Influences of Stress on the Measurement of Mechanical Properties Using Nanoindentation: I. Experimental Studies in an Aluminum Alloy", *Journal of Materials Research*. **11**, pp. 752-759 (1996).
- A. Bolshakov, W.C. Oliver, and G.M. Pharr, "Influences of Stress on the Measurement of Mechanical Properties Using Nanoindentation: II. Finite Element Simulations", *Journal of Materials Research*. **11**, pp. 760-768 (1996).
- M. Roy, J.Y. Rho, T.Y. Tsui, and G.M. Pharr, "Variation of Young's Modulus and Hardness in Human Lumbar Vertebrae Measured by Nanoindentation", *Advances in Bioengineering BED* **33**, pp. 385-386 (1996).
- J.-Y. Rho, T.Y. Tsui, and G.M. Pharr, "Elastic Properties of Human Vertebral Cortical and Trabecular Bone Measured by Nanoindentation", *Biomaterials* **18**, pp. 1325-1330 (1997).
- A. Bolshakov and G.M. Pharr, "Influences of Pile-up on the Measurement of Mechanical Properties by Load and Depth Sensing Indentation Techniques", *Journal of Materials Research*. **13**, pp. 1049-1058 (1998).
- G.M. Pharr, "Measurement of Mechanical Properties by Ultra-low Load Indentation", *Materials Science and Engineering A* **253**, 151-159 (1998).
- T.Y. Tsui and G.M. Pharr, "Substrate Effects on Nanoindentation Mechanical Property Measurement of Soft Films on Hard Substrates", *Journal of Materials Research*. **14**, pp. 292-301 (1999).
- J.-Y. Rho, M.E. Roy II, T.Y. Tsui, and G.M. Pharr, "Elastic Properties of Microstructural Components of Human Bone Tissue Measured by Nanoindentation", *Journal of Biomedical Materials Research* **45**, pp. 48-54 (1999).
- J.C. Hay, A. Bolshakov, and G.M. Pharr, "A Critical Examination of the Fundamental Relations in the Analysis of Nanoindentation Data", *Journal of Materials Research* **14**, pp. 2296-2305 (1999).
- J.-Y. Rho and G.M. Pharr, "Effects of Drying on the Mechanical Properties of Bovine Femur Measured by Nanoindentation", *Journal of Materials Science: Materials in Medicine* **10**, pp. 485-488 (1999).

- J.-Y. Rho, P. Zioupos, J.D. Currey, and G.M. Pharr, "Variations in the Individual Thick Lamellar Properties within Osteons by Nanoindentation", *Bone* **25**, pp. 295-300 (1999).
- G. Hofmann, M. Wiedenmeier, M. Freund, A. Beavan, J. Hay, and G.M. Pharr, "An Investigation of the Relationship Between Position Within Coater and Pyrolytic Carbon Characteristics Using Nanoindentation", *Carbon*. **38**, pp. 645-653 (2000).
- J.G. Swadener and G.M. Pharr, "Indentation of Anisotropic Elastic Half Spaces with Rigid Cones and Parabolas of Revolution", *Philosophical Magazine A* **81**, pp. 447-466 (2001).
- M.E. Roy, S.K. Nishimoto, J.-Y. Rho, S.K. Bhattacharya, J.S. Lin, and G.M. Pharr, "Correlations Between Osteocalcin Content, Degree of Mineralization, and Mechanical Properties of C. Carpio Rib Bone", *Journal of Biomedical Materials Research* **54**, pp. 547-553 (2001).
- D.L. Davidson and G.M. Pharr, "Matrix Properties of Textile-Reinforced Ceramic Matrix Composites Measured by Nanoindentation", *Journal of Composites Technology and Research* **23**, pp.102-110 (2001).
- J.-Y. Rho, J.D. Currey, P. Zioupos, and G.M. Pharr, "The Anisotropic Young's Modulus of Equine Secondary Osteons and Interstitial Bone by Nanoindentation", *Journal of Experimental Biology* **204** (Pt 10), pp. 1775-1781 (2001).
- J.G. Swadener, B. Taljat, and G.M. Pharr, "Measurement of Residual Stress by Load and Depth Sensing Indentation with Spherical Indenters", *Journal of Materials Research* **16**, pp. 2091-2102 (2001).
- J.G. Swadener, J.-Y. Rho, and G. M. Pharr, "Effects of Anisotropy on Elastic Moduli Measured by Nanoindentation in Human Tibial Cortical Bone", *Journal of Biomedical Materials Research* **57**, pp. 108-112 (2001).
- E.G. Herbert, G.M. Pharr, W.C. Oliver, B.N. Lucas, and J.L. Hay, "On the Measurement of Stress-Strain Curves by Spherical Indentation", *Thin Solid Films* **398**, pp. 331-335 (2001)].
- J.-Y. Rho, P. Zioupos, J.D. Currey, and G.M. Pharr, "Microstructural Elasticity and Regional Heterogeneity in Human Femoral Bone of Various Ages Examined by Nanoindentation", *Journal of Biomechanics* **35**, pp.189-198 (2002).
- J.G. Swadener, E.P. George, and G.M. Pharr, "The Correlation of the Indentation Size Effect Measured with Indenters of Various Shape", *Journal of Mechanics and Physics of Solids* **50**, pp.681-694 (2002).

- Z. Fan, J.G. Swadener, J.Y. Rho, M. Roy, and G.M. Pharr, "Anisotropic Properties of Human Tibial Cortical Bone as Measured by Nanoindentation", *Journal of Orthopaedic Research* **20**, pp. 806-810 (2002).
- K. Durst, M. Goeken, and G.M. Pharr, "Finite Element Simulation of Spherical Indentation in the Elastic-Plastic Transition", *Zeitschrift fur Metallkunde* **93**, pp. 857-861 (2002).
- G.M. Pharr and A. Bolshakov, "Understanding Nanoindentation Unloading Curves", *Journal of Materials Research* **17**, pp. 2660-2671 (2002).
- T.Y. Tsui, C.A. Ross, and G.M. Pharr, "A Method for Making Substrate-Independent Hardness Measurements of Soft Metallic Films on Hard Substrates by Nanoindentation", *Journal of Materials Research* **18**, pp. 1383-1391 (2003).
- C.M. Lepienski, G.M. Pharr, Y.J. Park, T.R. Watkins, A. Misra, and X. Zhang, "Factors Limiting the Measurement of Residual Stresses in Thin Films by Nanoindentation", *Thin Solid Films* **447**, pp. 251-257 (2004).
- Y.J. Park and G.M. Pharr, "Nanoindentation with Spherical Indenters: Finite Element Studies of Deformation in the Elastic-Plastic Transition Regime", *Thin Solid Films* **447**, pp. 246-250 (2004).
- Y.-T. Cheng, T.F. Page, G.M. Pharr, M.V. Swain, and K.J. Wahl, "Fundamentals and Applications of Instrumented Indentation in Multidisciplinary Research: Introduction", *Journal of Materials Research* **19**, pp. 1-2, 2004.
- W.C. Oliver and G.M. Pharr, "Measurement of Hardness and Elastic Modulus by Instrumented Indentation: Advances in Understanding and Refinements to Methodology", *Journal of Materials Research* **19**, pp. 3-20, 2004.
- D.L. Goldsby, A. Rar, G.M. Pharr, and T.E. Tullis, "Nanoindentation Creep of Quartz with Implications for Rate- and State-Variable Friction Laws Relevant to Earthquake Mechanics", *Journal of Materials Research* **19**, pp. 357-365, 2004.
- Wenge Yang, B.C. Larson, G.M. Pharr, G.E. Ice, J.D. Budai, J.Z. Tischler, and Wenjun Liu, "Deformation Microstructure Under Microindents in Single Crystal Cu Using 3D X-ray Structural Microscopy", *Journal of Materials Research* **19**, pp. 66-72, 2004.
- B. Taljat and G.M. Pharr, "Development of Pile-up During Spherical Indentation of Elastic-Plastic Solids", *International Journal of Solids and Structures* **41**, pp.3891-3904 (2004).
- N. Schwarzer and G.M. Pharr, "On the Evaluation of Stresses During Nanoindentation with Sharp Indenters", *Thin Solid Films* **469-470**, pp. 194-200 (2004).

- Jae-il Jang, M.J. Lance, S. Wen, T.Y. Tsui, and G.M. Pharr, "Indentation-Induced Phase Transformations in Silicon: Influences of Load, Rate and Indenter Angle on the Transformation Behavior", *Acta Materialia* **53**, pp. 1759-1770 (2005).
- Hyungyil Lee, Jin Haeng Lee, and George M. Pharr, "A Numerical Approach to Spherical Indentation Techniques for Material Property Evaluation", *Journal of the Mechanics and Physics of Solids* **53**, pp. 2037-2069 (2005).
- Jae-il Jang, M.J. Lance, S. Wen, and G.M. Pharr, "Evidence for Nanoindentation-Induced Phase Transformations in Germanium", *Applied Physics Letters* **86**, pp. 131907:1-3 (2005).
- H. Bei, E.P. George, J.L. Hay, and G.M. Pharr, "Influence of Indenter Tip Geometry on Elastic Deformation During Nanoindentation", *Physical Review Letters* **95**, 045501 (2005).
- S. Qu, Y. Huang, G.M. Pharr, and K.C. Huang, "The Indentation Size Effect in the Spherical Indentation of Iridium: A Study via the Conventional Theory of Mechanism-Based Strain Gradient Plasticity", *International Journal of Plasticity* **22**, pp. 1265-1286 (2006).
- N. Schwarzer, T. Chudoba, and G.M. Pharr, "On the Evaluation of Stresses in Coated Materials During Nanoindentation with Sharp Indenters", *Surface and Coatings Technology* **200**, pp. 4220-4226 (2006).
- Andrei Rar, G.M. Pharr, W.C. Oliver, E. Karapetian, and Sergei V. Kalinin, "Piezoelectric Nanoindentation", *Journal of Materials Research* **21**, pp. 552-556 (2006).
- N.M. Jennett, G.M. Pharr, and C.J. McHargue, "Instrumented Indentation Testing in Materials Research and Development", *Philosophical Magazine* **86**, pp. 5153-5155 (2006).
- Jeremy H. Strader, Sanghoon Shim, Hongbin Bei, W.C. Oliver, and G.M. Pharr, "An Experimental Evaluation of the Constant  $\beta$  Relating the Contact Stiffness to the Contact Area in Nanoindentation", *Philosophical Magazine* **86**, pp. 5285-5298 (2006).
- Y. Huang, F. Zhang, K.C. Hwang, W.D. Nix, G.M. Pharr, and G. Feng, "A Model of Size Effects in Nanoindentation", *Journal of the Mechanics and Physics of Solids* **54**, pp. 1668-1686 (2006).
- E.G. Herbert, W.C. Oliver, and G.M. Pharr, "On the Measurement of Yield Strength by Spherical Indentation", *Philosophical Magazine* **86**, pp. 5521-5539 (2006).

- Haitao Xu and G.M. Pharr, "An Improved Relation for the Elastic Compliance of a - Film/Substrate System During Indentation with Flat Cylindrical Punch", *Scripta Materialia* **55**, pp. 315-318 (2006).
- W.T.Y. Tze, S. Wang, T.G. Rials, G.M. Pharr, and S.S. Kelley, "Nanoindentation of Wood Cell Walls: Continuous Stiffness and Hardness Measurements", *Composites: Part A - Applied Science and Manufacturing* **38**, pp. 945-953 (2007).
- Y. Huang, X. Feng, G.M. Pharr, and K.C. Wang, "A Nanoindentation Model for Spherical Indenters", *Modelling and Simulation in Materials Science and Engineering* **15**, pp. S255-S262 (2007).
- S.-H. Lee, Y. Teramoto, S. Wang, G.M. Pharr, and T.G. Rials, "Nanoindentation of Biodegradable Cellulose Diacetate-graft-Poly(L-lactide) Copolymers: Effect of Molecular Composition and Thermal Aging on Mechanical Properties", *Journal of Polymer Science: Part B: Polymer Physics* **45**, pp. 1114-1121 (2007).
- S. Shim, W.C. Oliver, and G.M. Pharr, "A Comparison of 3D Finite Element Simulations for Berkovich and Conical Indentation of Fused Silica", *International Journal of Surface Science and Engineering* **1**, pp. 259-273 (2007).
- S.-H. Lee, S. Wang, G.M. Pharr, M. Kant, and D. Penumadu, "Mechanical Properties and Creep Behavior of Lyocell Fibers by Nanoindentation and Nanotensile Testing", *Holzforschung* **61**, pp. 254-260 (2007).
- Seung-Hwan Lee, Siqun Wang, G.M. Pharr, and H. Xu, "Evaluation of Interphase Properties in a Cellulose Fiber-Reinforced Polypropylene Composite by Nanoindentation and Finite Element Analysis", *Composites: Part A, Applied Science and Manufacturing* **38**, pp. 1517-1524 (2007).
- J. Qin, Y. Huang, K.C. Hwang, J. Song and G.M. Pharr, "The Effect of Indenter Angle on the Microindentation Hardness", *Acta Materialia* **55**, pp. 6127-6132 (2007).
- K. Durst, M. Goken, and G.M. Pharr, "Indentation Size Effect in Spherical and Pyramidal Indentations", *Journal of Physics D: Applied Physics* **41**, 074005 (2008).
- E.G. Herbert, W.C. Oliver, and G.M. Pharr, "Nanoindentation and the Dynamic Characterization of Viscoelastic Solids", *Journal of Physics D: Applied Physics* **41**, 074021 (2008).

#### **Books and Book Chapters**

1. M.F. Doerner, W.C. Oliver, G.M. Pharr, and F.R. Brotzen (editors), *Thin Films: Stresses and Mechanical Properties II*, *Materials Research Society Symposium Proceedings* **188**, Materials Research Society, Pittsburgh (1990).



2. R.F. Cook and G.M. Pharr, "Mechanical Properties of Ceramics", book chapter in *Materials Science and Technology: A Comprehensive Treatment*, edited by R.W. Cahn, P. Haasen, and E.J. Kramer, in Volume 11: *Structure and Properties of Ceramics* (Michael V. Swain - volume editor), pp. 339-407, VCH Publishers, Inc., New York (1994).
3. J.-Y. Rho and G.M. Pharr, "Nanoindentation Testing of Bone", book chapter in *Mechanical Testing of Bone and the Bone-Implant Interface*, edited by Y.H. An and R.H. Draughn, pp. 257-269, CRC Press, Boca Raton, FL (2000).
4. J.L. Hay and G.M. Pharr, "Instrumented Indentation Testing", book chapter in *ASM Handbook Volume 8: Mechanical Testing and Evaluation* (10th edition), edited by H. Kuhn and D. Medlin, pp. 232-243, ASM International, Materials Park, OH (2000).



**CERTIFICATE OF SERVICE**

The undersigned counsel certifies that, on September 4, 2008, he served the foregoing documents by email and by hand upon the following counsel:

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The undersigned counsel further certifies that, on September 4, 2008, he served the foregoing documents by email and by U.S. Mail upon the following counsel:

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